Advancing with Technology

ElektroPhysik

NAUMETRICS

premium measuring instruments

# Coating Thickness Measurement

## MiniTest 7400

### High-precision coating thickness gauge

- for non-destructive measurements on all metal substrates
- convenient graphics display with numerous display options
- intuitive menu control, enhanced data management with configuration assistant
- PC software for simplified configuration evaluation and set-up of data reports
- wear-resistant sensors for numerous measuring tasks up to 35 mm thickness
- SIDSP® technology for accurate and reproducible readings

# MiniTest 7400 with SIDSP® technology

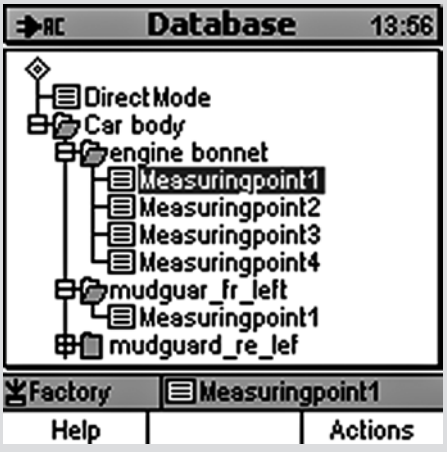
An innovative user interface concept combined with a highly convenient data management make the new MiniTest 7400 the ideal solution for today's measurement systems.

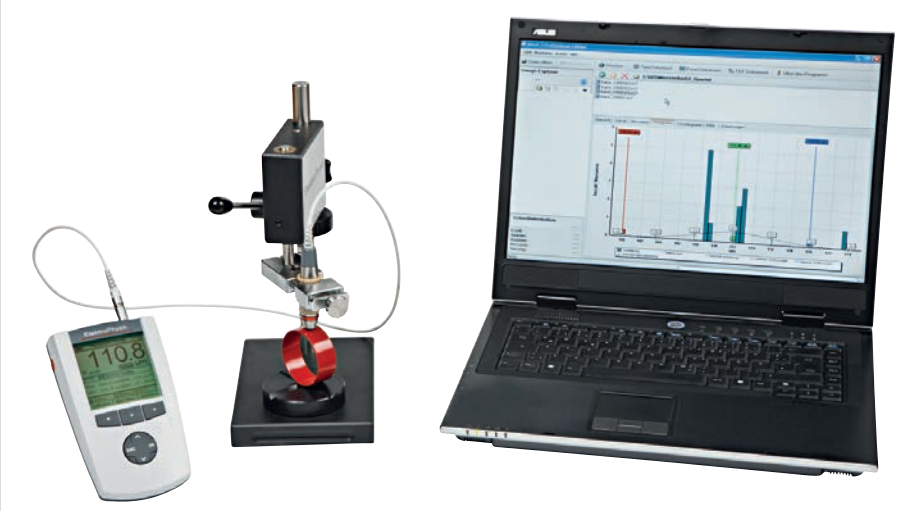
## Advantages of the new concept

The intuitive menu control with context-sensitive online help ensure ease of use. Large backlit control keys allow extra comfort even when wearing work gloves. Excellent viewing conditions are provided by the large backlit graphics display allowing convenient usage at night and in conditions of poor visibility.

Featuring a configuration assistant, the MiniTest 7400 simplifies the calibration and parameter set-up allowing to solve also difficult measuring tasks in a minimum of time without the need for special skills.

The advanced PC like data management offers quick creation of folders and easy set-up of customized batches. Apart from the numerical display of readings, the clearly arranged presentation of statistics and readings includes trend and histogram, process capability indices "Cp" and "Cpk" as well as block value statistics. Erroneous readings can be deleted from a batch in order to prevent misleading statistics.



The large data memory allows for storage of a number of 250,000 readings in a maximum of 500 batches for logical data management. To meet the requirements of high precision measurement, the MiniTest 7400 sensors can be calibrated at a maximum of 5 points (incl. zero). Predefined calibration methods are available to carry out measurement conforming to the Industrial norms and standards ISO 19840, SSPC, "Swedish", "Australian". In addition, a special calibration method is available for measurements on rough surfaces.

The delivery schedule includes the PC software package "MSoft 7 Professional" for convenient set up and evaluation of measuring groups and export in various data formats. The software exports data as text documents, Excel® spread sheets or in the PDF file format and allows entries of notes and annotations. Special features: also pictures of your measuring samples may be added to the data reports.

Equipped with numerous interfaces, the MiniTest 7400 connects to various peripheral devices. An infrared interface (IrDA® 1.0) is available as a standard feature. A multi-purpose adapter can be supplied as an option to act as a USB interface for connecting to various devices such as mains unit, headphones, a foot switch or an alert device. For single device connection, an RS232 and USB adapter cables as well as a USB to IrDA® converter are available.

# MiniTest 7400 with SIDSP® technology

Analogue signal processing has served its time – digital signal processing is the future

## SIDSP® advantages at a glance

Sensor-Integrated Digital Signal Processing, with this new technology, ElektroPhysik has set a new benchmark for innovative coating thickness measurement. High accuracy, unmatched reproducibility, high temperature stability along with an excellent adaptability, these are the main characteristics of SIDSP®. Innovative production techniques combined with automatic calibration procedures in which each sensor is calibrated individually allow for highest quality of the MiniTest 7400 sensors.

Take full advantage of the excellent basic sensor characteristics as given by the use of the SIDSP® technology. The unmatched precision during the manufacturing process enable highly identical characteristics for each individual sensor.

## Reproducibility

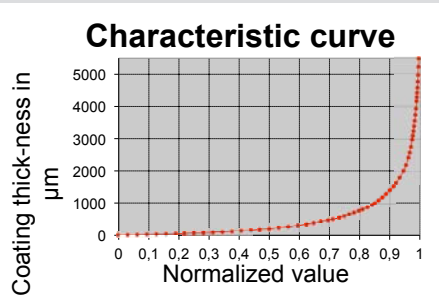
The reliability of readings mainly depends on the reproducibility of readings. Electromagnetic disturbances being most commonly the root of error, it is vital to protect the measuring system and sensor cable from such interference.

Unlike conventional techniques, the SIDSP® sensors create and control the excitation signals for the sensor head inside the sensor. The return signals are directly digitally converted and processed to provide the thickness value. This value is digitally transmitted to the display unit via the sensor cable. In other words: no more interference during signal transmission as is the case with analogue measuring systems. Even if your application requires an extremely long cable – no problem – the increased immunity to interference remains also with long cable extensions.

ElektroPhysik's SIDSP® sensors achieve a reproducibility unmatched so far. Place the sensor on the same measuring spot several times and you will obtain exactly the same result – another proof for the high performance of SIDSP® sensors.

## The manufacturing process

During the manufacture, the SIDSP® sensors undergo a special calibration procedure at as many as 50 points of the characteristic curve. Given this high number of points, the characteristic curve is most accurate so as to allow to eliminate (inevitable) variations of the sensor head. The calibration data being permanently stored in the sensor, they can be retrieved at any time, no matter which of the SIDSP® display units is connected. In addition, during the manufacturing process, the temperature behaviour of the sensors is permanently determined over the complete range of operating temperature. As a result, each sensor has got its indiviudally adpated temperature compensation allowing to compensate for large variations in temperature and the characteristic curve remaining accurate at any temperature.




## Sensor flexibility

Non ferrous metals may vary with respect to their conductivity. Featuring an automatic compensation for such substrate conductivity, the non-ferrous part of the eddy currents based N and FN sensors allow most accurate measurement on a large number of different types of non ferrous metals. Even in case of highly varying substrate conductivities, it is not necessary to recalibrate the sensor.

All SIDSP® sensors fully adapt to the geometry of a sample. Equipped with a calibration device for odd shapes, the sensors can be easily calibrated to your sample. The calibration will be valid over the complete range of your shape/substrate combination once a zero point calibration has been carried out on an uncoated sample of such shape/substrate combination.

# MiniTest 7400 sensors

## Sensor selection

A wide range of interchangeable sensors is available to meet the requirements of your application.
Via a push-pull connection system you can easily change the sensors.

| Sensor type | Measuring range/ Dimensions | Typical field of application/ Measuring principle | Figure |
|---|---|---|---|
| **F 0.5** | **0 ... 0.5 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steell<br>– small parts, thin coatings<br>– use with measuring stand<br>– magnetic induction principle<br>HD version:<br>– rugged design for harsh environment | |
| **F 1.5** | **0 ... 1.5 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steel<br>– small parts<br>– use with measuring stand<br>– magnetic induction principle<br>HD version:<br>– rugged design for harsh environment | |
| **F 1.5-90** | **0 ... 1.5 mm**<br>total length: **310 mm**<br>immersion length: **165 mm; 10.0 mm Ø**<br>(special length on request) | – non-magnetic coatings on steel<br>– especially appropriate for measurements in tubes and pipes or objects difficult to access<br>– thin coatings<br>– magnetic induction principle | |
| **F 2 HD** | **0 ... 2 mm**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steel<br>– rugged version for harsh environments<br>– especially appropriate for rough surfaces<br>– magnetic induction principle | |
| **F 5** | **0 ... 5 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steel<br>– standard sensor for a wide field of applications<br>– magnetic induction principle<br>HD version:<br>– rugged design for harsh environments | |
| **F 15** | **0 ... 15 mm**<br>right-angle cable outlet: **64.0mm length; 23.8 mm Ø**<br>straight cable outlet: **101 mm length; 23.8 mm Ø** | – non-magnetic coatings on steel<br>– thick paint, enamel or plastic coatings, protective coatings in tanks and pipes, e.g. glass, plastics, rubber and concrete linings<br>– wall thickness measurement (using steel plate as counter pole)<br>– magnetic induction principle | |
| **F 35** | **0 ... 35 mm**<br>right-angle cable outlet: **92.3 mm length; 57.1mm Ø**<br>straight cable outlet: **129 mm length; 57.1 mm Ø** | – non-magnetic coatings on steel<br>– thick paint, enamel or plastic coatings, protective coatings in tanks and pipes, e.g. glass, plastics, rubber and concrete linings<br>– wall thickness measurements using a steel plate as counter-pole<br>– magnetic induction principle | |

## Sensor selection

The dual sensors FN provide an automatic identification of the substrate material and switch to the suitable measuring principle upon contact with the surface. Application errors can thus be eliminated and the measuring process accelerated.

| Sensor type | Measuring range/ Dimensions | Typical field of application/ Measuring principle | Figure |
|---|---|---|---|
| **N 0.2** | **0 … 0.2 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – insulating coatings on non-ferrous metals<br>– small parts, thin coatings<br>– use with measuring stand<br>– eddy currents principle<br>HD version:<br>– rugged design for harsh environments | |
| **N 0.7** | **0 … 0.7 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – insulating coatings on non-ferrous metals<br>– small parts, thin coatings<br>– use with measuring stand<br>– eddy currents principle<br>HD version:<br>– rugged design for harsh environments | |
| **N 0.7-90** | **0 … 0.7 mm**<br>total length: **310 mm length;**<br>immersion length: **165 mm length; 10.0 mm Ø**<br>(special lengths on request) | – insulating coatings on non-ferrous metals<br>– especially appropriate for measurements in tubes and pipes or objects difficult to access<br>– thin coatings<br>– eddy currents principle | |
| **N 2.5** | **0 … 2.5 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – insulating coatings on non-ferrous metals<br>– standard sensor for a wide field of applications<br>– eddy currents principle<br>HD version:<br>– rugged design for harsh environments | |
| **N 7** | **0 … 7 mm**<br>right-angle cable outlet: **64.0 mm length; 23.8 mm Ø**<br>straight cable outlet: **101 mm length; 23.8 mm Ø** | – insulating coatings on non-ferrous metals<br>– thick coatings<br>– wall thickness measurements using an aluminium plate as counter-pole<br>– eddy currents principle | |
| **FN 1.5** | **F: 0 … 1.5 mm**<br>**N: 0 … 0.7 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steel and insulating coatings on non-ferrous metals<br>– small parts, thin coatings<br>– use with measuring stand<br>– dual sensor: magnetic induction principle/eddy currents principle<br>HD version:<br>– rugged design for harsh environments | |
| **FN 1.5-90** | **F: 0 … 1.5 mm**<br>**N: 0 … 0.7 mm**<br>total length: **310 mm length;**<br>immersion length: **165 mm length; 10.0 mm Ø**<br>(special lengths on request) | – non-magnetic coatings on steel and insulating coatings on non-ferrous metals<br>– especially appropriate for measurements in tubes and pipes or objects difficult to access<br>– thin coatings<br>– dual sensor: magnetic induction principle/eddy currents principle | |
| **FN 5** | **F: 0 … 5 mm**<br>**N: 0 … 2.5 mm**<br>right-angle cable outlet: **62.5 mm length; 15.3 mm Ø**<br>straight cable outlet: **100 mm length; 15.3 mm Ø**<br>HD version: **78.0 mm length; 20.5 mm Ø** | – non-magnetic coatings on steel and insulating coatings on non-ferrous metals<br>– standard sensor for a wide field of applications<br>– dual sensor: magnetic induction principle/eddy currents principle<br>HD version:<br>– rugged design for harsh environments | |

# MiniTest 7400 sensors

## Technical data

| Standard sensor | HD sensor | Measuring range | Accuracy [1, 5] (of reading) | Repeatability (standard deviation of reading) [5] | Low range resolution | Minimum curvature radius convex [2, 6] | Minimum curvature radius concave [2, 6] | Minimum measuring area [2, 6] without measuring stand | Minimum measuring area [2, 3, 6] with measuring stand | Minimum substrate thickness [2, 6] | Measuring rate in continuous mode | Max. measuring rate in single readings mode |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F 0.5 | F 05 HD | 0 ... 0.5 mm, 20 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.02 µm | 1.0 mm | 7.5 mm | Ø 14 mm | Ø 5 mm | 0.3 mm | 20 readings per second | 70 readings per minute [4] |
| F 1.5 | F 1.5 HD | 0 ... 1.5 mm, 60 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | 1.0 mm | 7.5 mm | Ø 14 mm | Ø 5 mm | 0.3 mm | | |
| F 1.5-90 | | 0 ... 1.5 mm, 60 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | – | 5 mm | Ø 10 mm | Ø 5 mm | 0.3 mm | | |
| | F 2 HD | 0 ... 2 mm, 80 mils | +/- (1.5 µm + 0.75 %) | +/- (0.8 µm +0.5 %) | 0.1 µm | 1.5 mm | 10 mm | Ø 14 mm | – | 0.5 mm | | |
| F 5 | F 5 HD | 0 ... 5 mm, 200 mils | +/- (1.5 µm + 0.75 %) | +/- (0.8 µm +0.5 %) | 0.1 µm | 1.5 mm | 10 mm | Ø 14 mm | Ø 10 mm | 0.5 mm | | |
| F 15 | | 0 ... 15 mm, 590 mils | +/- (5 µm + 0.75 %) | +/- (2.5 µm +0.5 %) | 1 µm | 5 mm | 25 mm | Ø 25 mm | Ø 25 mm | 1.0 mm | | |
| F 35 | | 0 ... 35 m, 1380 mils | +/- (20 µm + 0.75 %) | +/- (10 µm +0.5 %) | 5 µm | 50 mm | 50 mm | Ø 100 mm | – | 1.5 mm | | |
| N 0.2 | N 0.2 HD | 0 ... 0.2 mm, 8 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.02 µm | 1.0 mm | 7.5 mm | Ø 14 mm | Ø 5 mm | 40 µm | | |
| N 0.7 | N 0.7 HD | 0 ... 0.7 mm, 27 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | 1.0 mm | 7.5 mm | Ø 14 mm | Ø 5 mm | 40 µm | | |
| N 0.7-90 | | 0 ... 0.7 mm, 27 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | – | 5 mm | Ø 10 mm | Ø 5 mm | 40 µm | | |
| N 2.5 | N 2.5 HD | 0 ... 2.5 mm, 100 mils | +/- (1.5 µm + 0.75 %) | +/- (0.8 µm +0.5 %) | 0.1 µm | 1.5 mm | 10 mm | Ø 14 mm | Ø 10 mm | 40 µm | | |
| N 7 | | 0 ... 7 mm, 280 mils | +/- (5 µm + 0.75 %) | +/- (2.5 µm +0.5 %) | 1 µm | 15 mm | 25 mm [7] | Ø 23 mm | Ø 20 mm | 40 µm | | |
| FN 1.5 | FN 1.5 HD | F: 0 ... 1.5 mm, 60 mils<br>N: 0 ... 0.7 mm, 27 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | 1.0 mm | 7.5 mm | Ø 14 mm | Ø 5 mm | F: 0.3 mm<br>N: 40 µm | | |
| FN 1.5-90 | | F: 0 ... 1.5 mm, 60 mils<br>N: 0 ... 0.7 mm, 27 mils | +/- (1 µm + 0.75 %) | +/- (0.5 µm +0.5 %) | 0.05 µm | – | 5 mm | Ø 10 mm | Ø 5 mm | F: 0.3 mm<br>N: 40 µm | | |
| FN 5 | FN 5 HD | F: 0 ... 5 mm, 200 mils<br>N: 0 ... 2.5 mm, 100 mils | +/- (1.5 µm + 0.75 %) | +/- (0.8 µm +0.5 %) | 0.1 µm | 1.5 mm | 10 mm | Ø 14 mm | Ø 10 mm | F: 0.5 mm<br>N: 40 µm | | |

[1] With multi-point calibration, relating to the supplied standards under laboratory conditions
[2] With zero calibration and if calibration was made close to the coating thickness to be expected
[3] If the precision stand is used, not applicable for HD sensors
[4] If the „quick" filter has been selected, measuring rate mainly dependent on handling
[5] According to DIN 55350 part 13
[6] With multi-point calibration values better than the specified data can be obtained.
[7] including coating

## Sensor design options

Different cable outlet styles provide flexibility to adapt to your measuring task. Each standard-sensor can be supplied either with straight cable outlet or in right-angle design, latter allowing you to measure samples difficult to access such as tubes or hollow parts.

Harsh environments or contamination through paint or dust particles require specially adapted sensors. To provide the ultimate protection to your harsh environment demands, the MiniTest 7400 line offers a special range of rugged sensors (HD sensors). These sensors feature a special grout sealing to protect the sensor electronics. An external spring mounting system is provided to ease sensor cleaning.

**F 2 HD sensor**

For rough surfaces, a sensor type "F 2 HD" is available with a sensor pole specially adapted to rough surfaces.

# MiniTest 7400 Accessories

## Recommended accessories

| | |
|---|---|
| **1.** MiniPrint 7000 portable data printer for wireless print-out of readings and statistics via IrDA® 1.0, including storage battery and charger unit | |
| **2.** Quick charger unit for NiMH storage batteries | |
| **3.** Mains unit | |
| **4.** Foot switch for data storage trigger including mains adapter unit | |
| **5.** Shoulder bag with belt | |
| **6.** Rubber protection case with mounting device and shoulder strap | |
| **7.** Multi-purpose connection box incl. USB cable for connecting:<br>– Mains unit<br>– Foot switch<br>– Alarm device<br>– Headphones | |
| **8.** USB connection cable | |
| **9.** RS 232 connection cable | |
| **10.** IR/ USB converter | |
| **11.** Precision support for serial measurements or measurements on small parts<br><br>**without picture:**<br>**12.** Calibration foils with various thickness values<br>**13.** Manufacturer's Test Certificate according to DIN 55350 M for MiniTest 7400 and sensors and Calibration standards<br>**14.** Right-angle cable outlet | |

# MiniTest 7400 Gauge

| Technical data MiniTest 7400 | |
|---|---|
| Max. number of batches | 500 |
| Max. number of storable readings | approx. 250,000 readings in total |
| Statistics (per batch) | number of readings, minimum, maximum, average, standard deviation, coefficient of variation, block statistics (norm-conforming/free configurable), process capability indices Cp and Cpk, histogram, trend |
| Calibration procedures according to international norms and standards | ISO, SSPC, „Swedish “, „Australian“ |
| Calibration | up to 5 points, user adjustable offset value |
| Monitoring of limits | visual and audible alarm to indicate deviations from set limits |
| Measuring units | µm, mm, cm, mils, inch, thou |
| Operating temperature | –10°C … 60°C; 14°F … 140°F |
| Storing temperature | –20°C … 70°C; -4°F … 158°F |
| Data port | IrDA® 1.0, USB and RS232 with optional adapter |
| Power supply | 4 x AA (LR06) batteries, or optional power unit (90 – 240 V~ / 48 – 62 Hz) |
| Norms and standards | DIN EN ISO 1461, 2064, 2178, 2360, 2808, 3882, 19840, AS3894; SS 1841 60, SSPC-PA 2, IMO-PSPC, ASTM B 244, B 499, D 7091, E376 |
| Display | 160 x 160 pixel LCD with backlight |
| Dimensions | 153 mm x 89 mm x 32 mm; 6 inch x 3.5 inch x 1.3 inch |
| Weight | 310 g; 11 oz. (gauge incl. batteries) |

## Supply schedule

### Gauge:

- MiniTest 7400
- MSoft 7 Professional software
- Instructions manual in German, English, French and Spanish
- Short instructions
- 4 AA cells, type LR06
- Plastic carrying case

### Sensor:

- SIDSP® sensor according to choice including certificate
- Calibration set with calibration foils and zero reference plate(s)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